On the Foraging Behavior of Beaked Whales and Other Deep Diving Odontocetes

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LONG-TERM GOALS

The long-term goal of our research is to understand beaked whale foraging process and to learn how to alleviate acoustic encounters between Navy asserts and beaked whales and other deep diving odontocetes. The more specific goal of this proposal is to fabricate an integrated instrumentation system that can be used to study foraging behavior of deep diving beaked whales. The most effective manner to minimize acoustic encounters is to have knowledge of the movement patterns of beaked whales in any given body of water. Since the movement patterns of any animals is strongly affected by the availability of food resources, it is critical to understand the foraging behavior of beaked whales, the behavior of the prey, the oceanographic conditions affecting the presence of the prey and how the whales interact with the prey field.

OBJECTIVES

Our long-term objectives can be summarized as follows:

1. estimate the three-dimensional spatial extent of potential prey field
2. collect synoptic data of beaked whale foraging on the prey field
3. determine the taxa composition of the prey field
4. estimate the size and density of the micronekton in the prey field
5. correlate relevant oceanographic parameters with the presence of the prey field
6. map the spatial and temporal pattern of beaked whales in the study area

APPROACH

In order perform foraging research on deep diving forager, an integrated suite of instruments that can perform biomass estimates at depths between 700 and 1200 m with sufficient resolution is required. Such an integrated system **does not exist** but such a system is extreme important in order to understand the foraging behavior of beaked whales. We propose to fabricate an integrated system consisting of ship based scientific echosounders and a profiler equipped with a suite of instrumentation which will be used in conjunction with ship based echosounders to measure the three-dimensional spatial extent

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and temporal dynamics of the prey field and to collect synoptic data of beaked whales foraging on the prey field. All the instruments on the profiler are "**off the shelf," tested and proven to work well**. These instruments will be integrated to work as a system on the profiler. Straight line transects will be used to survey for both beaked whales and their prey in order to determine location, abundance and density of the prey. The profiler will be used at opportune times when good prey layers with beaked whale foraging are found.

We propose to "ground truth" an integrated system and develop measurement protocols first in Hawaiian waters off the island of Hawaii where beaked whales can be regularly found and to also operate in waters associated with the underwater acoustic test range of the Pacific Missile Range Facility (PMRF) off the island of Kauai and . We would also used our system in other areas of high Naval interest such as the Autec range in the Caribbean and other areas where the Navy is supporting beaked whale foraging research. The results from such an integrated instrument system will provide extremely valuable data to current ongoing research to develop predictive models for marine mammal location and movement such as the SERDIP program "Acoustic Response and Detection of Marine Mammals on Navy Range using Digital Acoustic Recording Tags" of Dr. Peter Tyack.

Instrumented Profiler

The instrumented profiler will support a suite of important instruments that would allow us to collect important data on prey along with oceanographic information. A schematic of the profiler is shown in Figure 1. A description of the instruments that will be housed on the profilers will be included below. The instruments will be turned on and off using a acoustic remote unit operated from the surface. The depth of the profiler will be determined in real-time by monitoring the EK-60 echosounders.

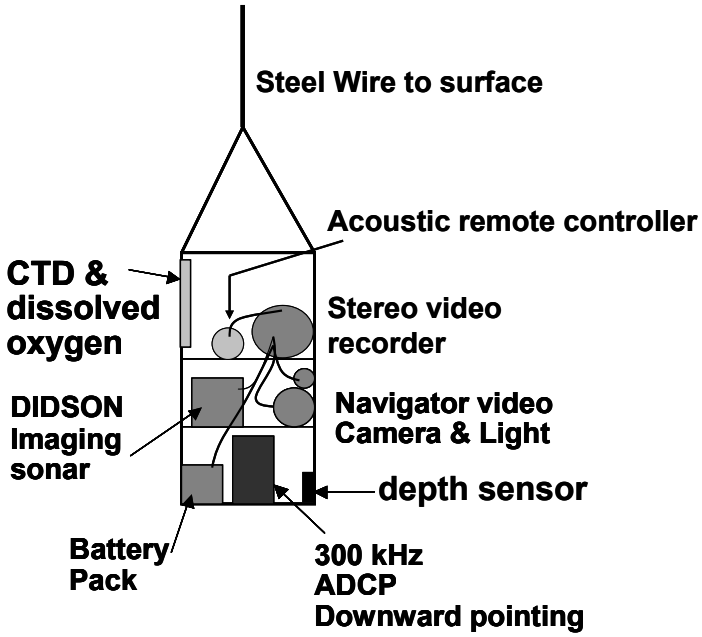

Figure 1. Schematic of the prey-field profile showing the various instruments it will support for a close examination of the prey field.

WORK COMPLETED

All but one of the major equipment has been ordered. One more instrument needs to be procured, an ADCP (Acoustic Doopler Current Probe) to measure the currents at the depth of the mesopelagic layer.

RESULTS

This is an equipment grant so no measurements or data collection has been performed.

IMPACT/APPLICATIONS

Potential future impact for Science and/or Systems Applications is gaining knowledge of how beaked whales forage and an understanding the prey field upon which they forage on. Such knowledge will be of much help to mitigating potential problems with Navy sonar training exercises as well as other exercises. Successful results and methods used in this project could also be applied to other areas of high Naval activities.

RELATED PROJECTS

None.